DENSO ROBOT

RC8 CONTROLLER

ELECTRIC GRIPPER CONTROL BOARD

USER'S MANUAL

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1. Preface

Thank you for purchasing our DRH-ESG1 Series Electric Gripper.

This operation manual contains information necessary to use the DRH-ESG1 Series. Be sure to read the respective operation/instruction manuals for the electric gripper, electric gripper control board, and electric gripper command to gain a firm understanding of their content before use. Be sure to store the manual in a readily accessible location after reading in order that it may referenced at any time.

2. FOR SAFE USE

Cautionary descriptions given here are for correct use of the products and for prevention of hazard on you and other people in vicinity and damage with equipment. These descriptions are divided into three items of “DANGER”, “WARNING” and “CAUTION” depending on the severity of hazard or damage and level of imminence. All bear important descriptions pertaining to safety. Strictly observe the instructions in addition to those of ISO 10218-2*[1)] and other safety rules.

DANGER	Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.
WARNING	Indicates a potentially hazardous situation which could result in death or serious injury, if the equipment is operated wrongly.
CAUTION	Indicates a potentially hazardous situation which may result in injury and machine damage, if the equipment is operated wrongly.

1) ISO 10218-2: Robots and robotic devices -- Safety requirements for industrial robots -- Part 2: Robot systems and integration

- This product is designed and manufactured as a component for use in general industrial machinery.
- Devices must be selected and handled by a system designer, personnel in charge of the actual operation using the product or similar individual with sufficient knowledge and experience.
- Be sure to read the catalogue and operation manual before handling the product. Mishandling of the product poses a risk. Please read the respective operation/instruction manuals for the electric gripper, electric gripper control board, and electric gripper command.
- It is the user’s responsibility to verify and determine the compatibility of this product with the user’s system, and to use them properly.
- After reading the catalog, operation manual and other materials, be sure to keep them in a convenient place easily accessible to the personnel using this product.
- The danger, warning and caution directions in this “Safety Precautions” do not cover every possible case. Please read the catalog and operation manual for the given device, particularly for descriptions unique to it, to ensure its safe and proper handling.
- If the electric gripper is used integrated into a system (machine, robot, etc.), the system must satisfy regulations and standards for safety measures. First check

whether the system satisfies the relevant regulations and standards, and if so, handle the product properly in accordance with the regulations and standards. The electric gripper is an end effector for the robot system. When you design and/or assemble an electric gripper, be sure to satisfy all requirements and conditions written in ISO 10218-2.

- When you design and/or assemble an electric gripper, you must comply with the stipulation of ISO10218-2 "End-effectors shall be designed and constructed so that the loss or change of energy supply (e.g. electrical, hydraulic, pneumatic, vacuum supply) does not cause release of the load that would result in a hazardous condition. When practicable, power can be supplied to end-effectors for troubleshooting without applying motive energy to the robot actuator(s)."
- Do not use the product for the following applications:
    1. Medical equipment used to maintain, control or otherwise affect human life or physical health
    2. Mechanisms and machinery designed for the purpose of moving or transporting people
    3. Important safety parts of machinery

This product has not been planned or designed for applications requiring high levels of safety. Use of this product in such applications may jeopardize the safety of human life.

2.1. CAUTION

2.1.1. General

Do not use the product outside the specifications. Using the product outside the specifications may cause it to fail, stop functioning or sustain damage. It may also significantly reduce the service life of the product.

2.1.2. Design

- If the machine will stop in the case of system (machine, robot, etc.) problem such as emergency stop or power failure, design a safety circuit or other device that will prevent equipment damage or injury.
- To avoid falling a work piece that the electric gripper holds when the loss of power supply to the robot, design a circuit so that the power supply for the electric gripper is maintained or design fingers so that it does not drop a work piece.
- If you require an electric gripper that equips a function to keep holding a work piece (grip force), please contact our sales representatives.

2.1.3. Operating Environment

- Do not use this product in a place exposed to ignitable, inflammable or explosive substances. The product has not been designed with explosion protection. The product may explode or ignite, resulting in product damage or injury.
- Do not use the product in a place where it may be exposed to water or oil droplets.

2.1.4. Installation

Wire the product correctly by referring to the operation manual. Securely connect the cables and connectors so that they will not be disconnected or come loose. Failure to do so may cause the product to malfunction or cause fire.

2.1.5. Operation

- When operating or adjusting the gripper after it was mounted to the system (machine, robot, etc.), be sure to observe safety measures for the system. Failure to do so may result in serious injury.
- Before supplying power to and operating the product, always check the operation area of the equipment to ensure safety. Supplying power to the product carelessly may cause electric shock or injury due to contact with the moving parts.
- Do not touch the connectors or other parts power being supplied to the product. It may result in electric shock or malfunction.
- If you are using a pace maker or other mechanical implant, do not come within one meter of the product. The strong magnetic field generated by the product may cause the pace maker, etc., to malfunction. Keep pacemaker wearers one meter away from the product. The pacemaker may not work properly due to strong magnetic affection.
- Do not pour water onto the product. Spraying water over the product, washing it with water or using it in water may cause the product to malfunction, resulting in injury, electric shock, fire, etc.
- When conducting operation checks or performing operation, increase the robot speed gradually to check whether the electric gripper gripping force can be sustained relative to the robot speed. If not, there is a possibility of danger such as flying workpieces.

2.1.6. Maintenance and Inspection

- If the electric gripper is used integrated into a system (machine, robot, etc.), ensure that regulations and standards for safety measures are strictly observed, and use the

product properly and safely.

- Do not disassemble and reassemble the components relating to the basic structure of the product or its performance and function. Doing so may result in injury, electric shock, fire, etc.
- Never cut and/or reconnect the cables supplied with the product for the purpose of extending or shortening the cable length. Doing so may result in fire.

2.2. WARNING

2.2.1. Operating Environment

- Do not use the product under direct sunlight or ultraviolet ray.
- Do not expose the product to radiant heat generated from a heat source.
- Use the product within the ambient temperature range of 0℃ to 40℃.
- Use the product in the place having humidity range of 35% to 85% (without dew condensation).
- Do not use the product in an atmosphere of corrosive gases (sulfuric acid or hydrochloric acid). Rust may form and reduce the structural strength of the product.
- Do not use the product in a place exposed to dust, iron powder. If dust enters the product through small openings and gaps, the product may suffer damage.
- Do not use the product in a place where it may come in contact with water droplets, cutting oil, cleansing liquid, organic solvent, and operating oil. If expected, sufficiently protect the product with a cover or panel. Since the product has not been designed with waterproof, water droplets or other liquid may enter the product, resulting in product damage.
- Do not install the product in a place subject to large vibration or impact (9.8 m/s2). Doing so may result in the malfunctioning of the product.
- Do not use the product in the place where high magnetic field may cause electromagnetic interference. Failure to do so may result in malfunction.
- Do not use the product in the places where large current or high magnetic field is present, welding or other operations are performed that cause arc discharge, subject to electrostatic noise, and with potential exposure to radiation. Failure to do so may result in malfunction.

2.2.2. Installation

- Provide an emergency-stop device in a readily accessible position so the device can be actuated immediately upon occurrence of a dangerous situation during operation.

Lack of such device in an appropriate position may result in injury.

- When installing the product including fingers, be sure to securely support and mount them. Failure to do so may cause the product or workpiece to tip over, drop or malfunction, resulting in injury.
- Provide sufficient maintenance space when installing the product. Routine inspection and maintenance cannot be performed without sufficient space, which will eventually cause the equipment to stop or the product to sustain damage.
- Before installing or adjusting the product or performing other operations on the product, display a sign that reads, “WORK IN PROGRESS. DO NOT TURN ON POWER.” If the power is turned on inadvertently, injury may result due to electric shock or sudden activation of the controller.
- Do not hold the moving parts of the product or its cables during installation. It may result in injury.

2.2.3. Operation

- Keep your fingers away from the product to prevent you from being caught into the other devices.
- Do not touch the connectors or exposed terminals of the electric gripper control board. Doing so may result in electric shock.
- Turn off the power to the product in the event of power failure. Failure to do so may cause the product to suddenly start moving when the power is restored, thus resulting in injury or product damage.
- When moving electric gripper finger by hand for the purpose of manual positioning, etc., confirm that the motor is turned off beforehand. Failure to do so may result in injury.
- If the product is generating heat, smoke or a strange smell, turn off the power immediately. Continuing to use the product may result in product damage or fire.
- If any of the internal protective devices (alarms) of the product has actuated, turn off the power immediately. Continuing to use the product may result in product damage or injury due to malfunction. Once the power supply is cut off, investigate and remove the cause and then turn on the power again.

2.2.4. Maintenance and Inspection

- Before conducting maintenance/inspection, parts replacement, or other operations on the product, completely shut down the power supply. At this time, take the following measures:

1. Display a sign that reads, “WORK IN PROGRESS. DO NOT TURN ON POWER” at a conspicuous place, in order to prevent a person other than the operator from accidentally turning on the power while the operation is working.
2. When two or more operators are to perform maintenance/inspection together, always call out every time the power is turned on/off or a moving part is moved in order to ensure safety.

- Perform inspection or maintenance work with a thorough understanding of the specific tasks. Insufficient maintenance/inspection by the user may result in reduction of service life of the moving parts and malfunction. If any abnormalities are detected, stop the operation immediately.

2.2.5. Disposal

Do not throw the product into fire. The product may burst or generate toxic gases.

2.3. CAUTION

2.3.1. General

- If you are planning to use the product under a condition or environment not specified in the catalogs or operation manual, or in an application requiring strict safety such as aircraft facility, combustion system, entertainment machine, clean room, safety device, or other equipment having significant impact on human life or property, design operating ranges with ample margins from the ratings and design specifications, or provide sufficient safety measures such as fail-safes. Whatever you do, always consult us.
- Always use the cable supplied with the product for connection between the electric gripper and electric gripper control board.
- Use DENSO WAVE genuine products for main components such as electric gripper, electric gripper control board.

2.3.2. Working Environment

- Provide sufficient space when performing maintenance and inspection safely.
- Do not bring a floppy disk or other magnetic media within one meter of the product. The magnetic field generated by the magnet may destroy the data in the floppy disk, etc.

2.3.3. Fixing the Product

- When handling the product, wear protective gloves, protective goggles, safety shoes, or other necessary gear to ensure safety.
- Protect the product from excessive impact load such as bumping or throwing.
- Do not step onto the package or place on the package a heavy object that allows the load concentrate.
- After unpacking the product, do not carry by holding cables or connectors.
- The electric gripper connection cables supplied with the product are flexible, but do not store the cables in a movable cable duct (cable bearer, etc.) that bends more than the specified bending radius.
- Do not scratch the electric gripper connection cable. Scratching, forcible bending, straining, winding, and pinching may cause short circuit and insulation failure, which results in electric shock and malfunction.
- The workpiece gripping force will be lost if an emergency stop condition or power failure occurs. Take measures to prevent workpieces from dropping at such times.

2.3.4. Operation

- Turn on the power to individual equipment one by one, starting from the equipment at the highest level in the system hierarchy. Failure to do so may cause the product to start suddenly, resulting in injury or product damage
- Do not insert a finger or object in the openings in the product. It may cause fire, electric shock, or injury.
- The motor incorporated into the product generates a large amount of heat during operation, and the product surface temperature is high. Take care not to affect the workpiece or other objects around the gripper.

2.3.5. Maintenance and Inspection

Never touch terminals while performing insulation resistance test. Doing so may result in electric shock. (Do not perform dielectric strength test, because DC power is supplied with the product.)

2.3.6. Storage Environment

The environment in which the gripper is stored must be:

- Not exposed to direct sunlight and moisture
- Be dark cool and 30 cm higher or more than the floor surface to prevent occurrence of dew condensation
- Be free from large vibration and impact

2.3.7. Disposal

When the product no longer becomes usable or necessary, dispose of it properly as an industrial waste.

3. Overview

3.1. Outline

The DRH-ESG1 Series electric gripper control board is a high-performance product designed to build application systems for the assembly and transfer of workpieces by increasing and decreasing the gripping speed in combination with the electric gripper.

3.2. Features

- Robot controller (RC7M) integration

  Surplus wiring between the gripper controller and robot controller has been eliminated by integrating the electric gripper control board into the robot controller (RC7M).

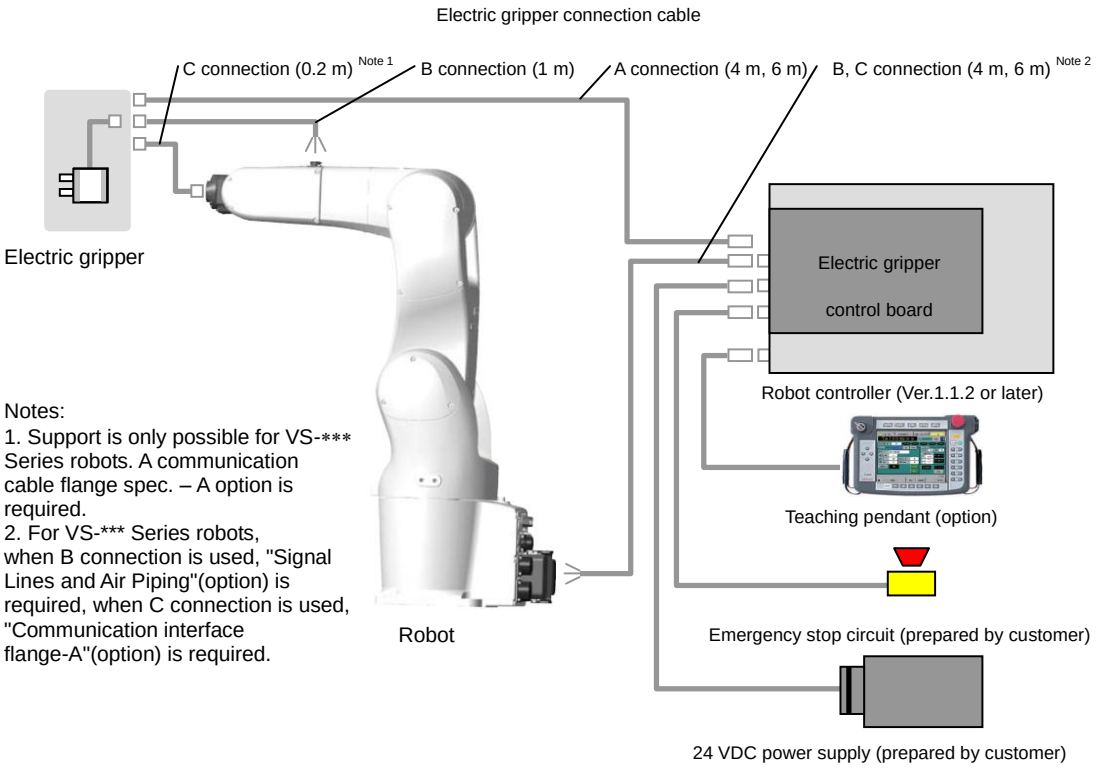
  Control is made easy using the electric gripper command.

- Broad-based compatibility

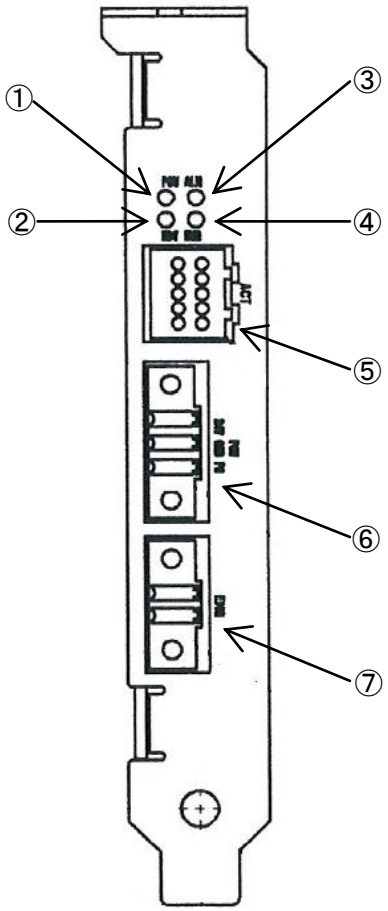
  The electric gripper control board is compatible with all DRH-ESG1 Series electric grippers.

- Easy gripping force control has been realized by using in combination with the electric gripper.

3.3. System Configuration


Electric gripper connection cable
C connection (0.2 m) Note 1
B connection (1 m)
A connection (4 m, 6 m)
B, C connection (4 m, 6 m) Note 2
Electric gripper
Electric gripper
control board
Robot controller (Ver.1.1.2 or later)
Teaching pendant (option)
Emergency stop circuit (prepared by customer)
24 VDC power supply (prepared by customer)
Robot
Notes:
1. Support is only possible for VS-*** Series robots. A communication cable flange spec. – A option is required.
2. For VS-*** Series robots, when B connection is used, "Signal Lines and Air Piping"(option) is required, when C connection is used, "Communication interface flange-A"(option) is required.

3.4. Names and Functions of Connectors and LEDs

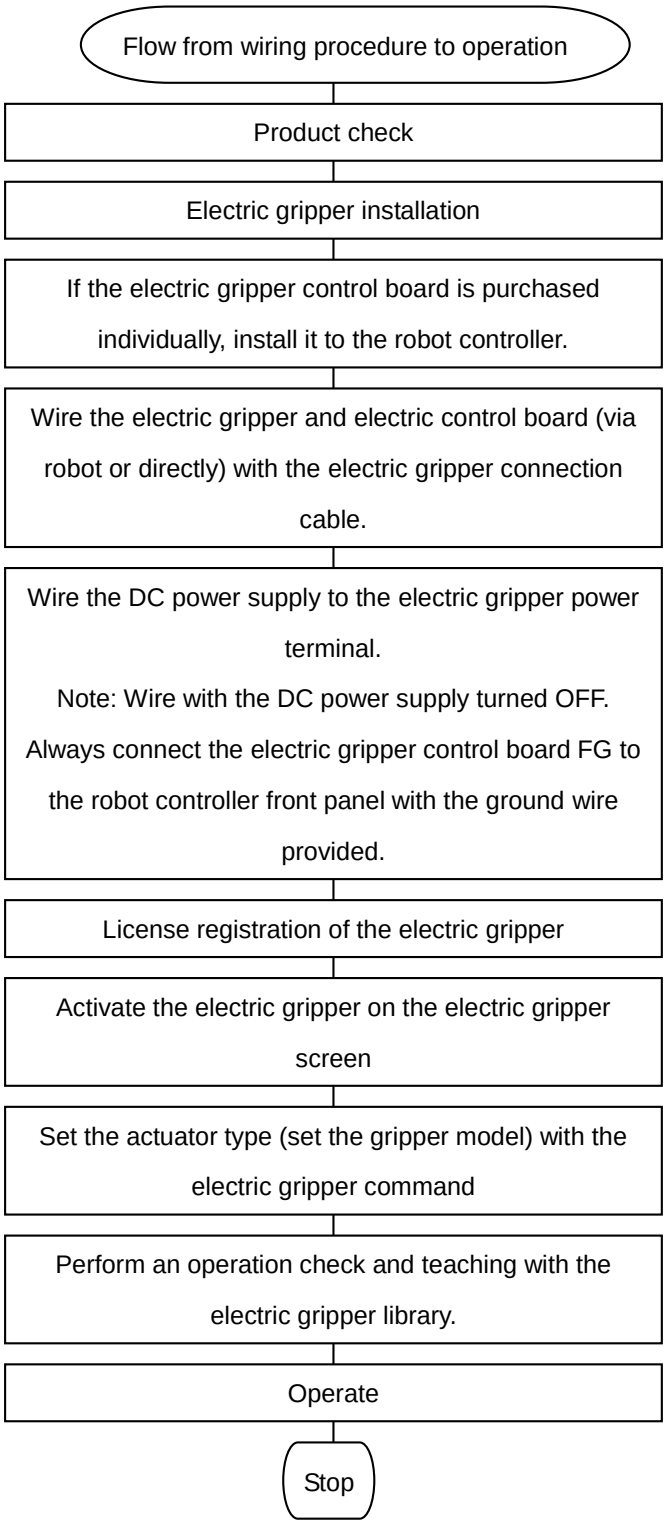


No	Name	Connector/LED	Function
1	POW	LED	Lights up (green) when the electric gripper power is ON.
2	RDY	LED	Lights up (yellow) when the electric gripper control board is functioning normally.
3	ALM	LED	Lights up (red) when an alarm occurs.
4	RUN	LED	Lights up (yellow) when the electric gripper is operating.
5	ACT	Connector	This connector is used for connection to the electric gripper.
6	POWER	Connector	This connector is used to supply power to the electric gripper.
7	EMG	Connector	This connection is used to connect emergency stop wiring.

4. Handling Procedures and Cautions

4.1. Installation and Connection with External Equipment

Refer to the basic flowchart showing the process that contains identification, installation, wiring, trial operation, and actual operation of the purchased product. In this chapter, the procedure flow from identification to installation and wiring of the product is described.


Flow from wiring procedure to operation
Product check
Electric gripper installation
If the electric gripper control board is purchased individually, install it to the robot controller.
Wire the electric gripper and electric control board (via robot or directly) with the electric gripper connection cable.
Wire the DC power supply to the electric gripper power terminal.
Note: Wire with the DC power supply turned OFF.
Always connect the electric gripper control board FG to the robot controller front panel with the ground wire provided.
License registration of the electric gripper
Activate the electric gripper on the electric gripper screen
Set the actuator type (set the gripper model) with the electric gripper command
Perform an operation check and teaching with the electric gripper library.
Operate
Stop

4.1.1. Handling the Packed Controller

⚠ CAUTION

- Do not apply excessive impact on the package by dropping or hitting.
- When setting down the package, keep it horizontal
- Do not step onto the package.
- Do not place a heavy object that can deform the package on the package or article of a shape that allows the load to concentrate.

4.1.2. Handling the Unpacked Control board

⚠ CAUTION

- When transporting the controller, take care not to hit it against other object.
- Avoid applying excessive force to any part of the electric gripper control board.
- Never directly touch the power terminals and signal terminals.
- Take due care not to drop the control board when unpacking. Failure to observe this may result in damage to the electric gripper control board or injury.
- Should you find any part of the control board damaged or missing during transportation, please contact us immediately.

4.1.3. Installation and Operation Environment

⚠ CAUTION

Install the controller in an environment meeting the conditions listed below.

Install the product in an operating environment meeting the conditions shown in the table below:

No	The environment in which the controller is used must
1	Not expose the product to direct sunlight.
2	Be free from radiant heat coming from equipment that generates a large amount of heat, such as a heat treatment furnace.
3	Have ambient temperature of 0ºC to 40ºC
4	Humidity of 85% or below (without dew condensation).
5	Be free from corrosive gas or flammable gas.
6	Be suitable for normal assembly work and free from excessive dust.
7	Be free from oil mist or cutting fluid.
8	Be free from vibrations exceeding 1.0G.
9	Be free from strong electromagnetic wave, ultraviolet light, radiation.
10	Chemical resistance is not considered in the design of the product. Be free from chemical vapors and gases.

4.1.4. Storage Environment

CAUTION

The storage environment should basically conform to the installation environment. If the controller is to be stored for an extended period of time, provide appropriate measures to prevent dew condensation. The controller is not packed with desiccating agent, until otherwise specified by the user. If the controller is to be stored in an environment where dew condensation may occur, take appropriate measure to protect the entire package, or the controller itself after unpacking it, from detrimental effects of dew condensation. The controller can withstand an ambient temperature of up to 60℃ for a short period. If the controller is to be stored for over one month, keep the ambient temperature at 50℃ or below.

4.1.5. Installation

If the electric gripper control board is purchased individually, the customer is responsible for installing it in the robot controller. Refer to “Expansion Board Attachment” in the “RC7M Controller Optional Device Operation Manual” for details of the installation method.

CAUTION

- Avoid applying any impact or load to the electric gripper control board connectors. Failure to observe this may result in damage to the baseboard inside the electric gripper control board.
- Avoid applying an excessive force to the connectors by forcibly pulling the cables.
- Avoid installing the electric gripper control board in locations where it may be exposed to oil or water.
- Install in a stable location. Avoid installing in places subject to frequent vibrations.
- Avoid installing the controller in the locations where ambient temperature could be high.

4.1.6. Electric Gripper and Wiring to Control Board

Use the electric gripper connection cables provided to wire the electric gripper and electric gripper control board. The wiring will differ depending on the robot controller connection type.

⚠ WARNING

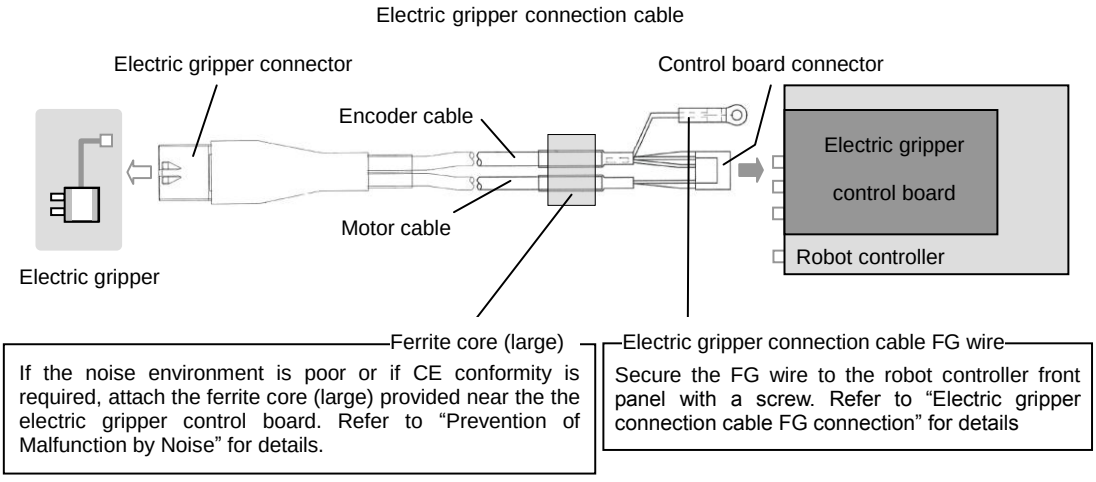
- Do not turn on the power while wiring the controller.
- Wire the controller by referring to the wiring diagram and check for proper wiring.

⚠ CAUSE

- Special care should be taken not to bend or pull the cable with a strong force when wiring the controller.
- A SG shielded cable is employed to the encoder cable, but avoid laying the encoder cable that may cause malfunction together with a large current cable. Failure to do so may result in malfunction.

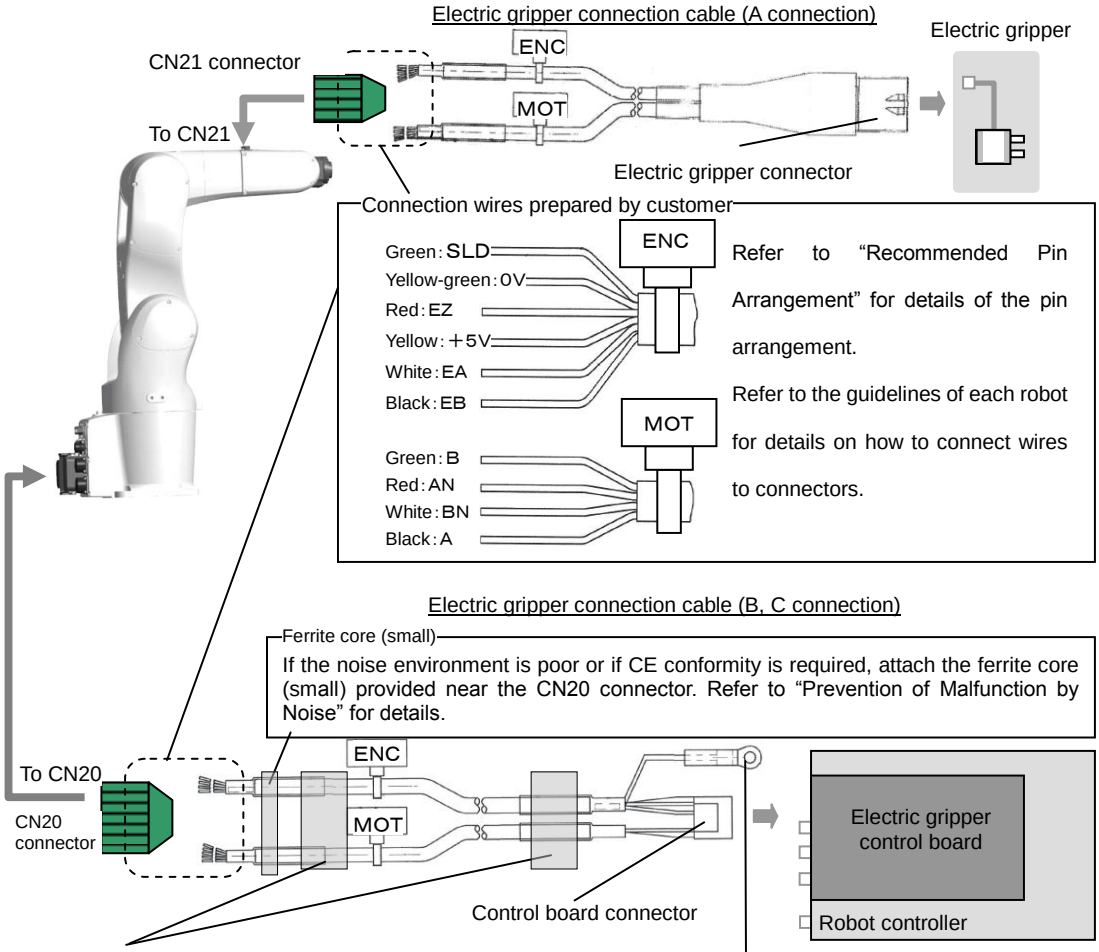
A connection

Connect as shown in the diagram below.


Electric gripper connection cable
Electric gripper connector
Control board connector
Encoder cable
Motor cable
Electric gripper
Electric gripper control board
Robot controller
Ferrite core (large)
If the noise environment is poor or if CE conformity is required, attach the ferrite core (large) provided near the the electric gripper control board. Refer to “Prevention of Malfunction by Noise” for details.
Electric gripper connection cable FG wire
Secure the FG wire to the robot controller front panel with a screw. Refer to “Electric gripper connection cable FG connection” for details

B connection

Connect as shown in the diagram below.


Electric gripper connection cable (A connection)
Electric gripper
CN21 connector
ENC
MOT
To CN21
Electric gripper connector
Connection wires prepared by customer
ENC
Green: SLD
Yellow-green: 0V
Red: EZ
Yellow: +5V
White: EA
Black: EB
MOT
Green: B
Red: AN
White: BN
Black: A
Refer to "Recommended Pin Arrangement" for details of the pin arrangement.
Refer to the guidelines of each robot for details on how to connect wires to connectors.
Electric gripper connection cable (B, C connection)
Ferrite core (small)
If the noise environment is poor or if CE conformity is required, attach the ferrite core (small) provided near the CN20 connector. Refer to "Prevention of Malfunction by Noise" for details.
To CN20
CN20 connector
ENC
MOT
Control board connector
Electric gripper control board
Robot controller
Ferrite core (large)
If the noise environment is poor or if CE conformity is required, attach the ferrite core (large) provided near the electric gripper control board. Refer to "Prevention of Malfunction by Noise" for details.
Electric gripper connection cable FG wire
Secure the FG wire to the robot controller front panel with a screw. Refer to "Electric gripper connection cable FG connection" for details

Pin arrangement

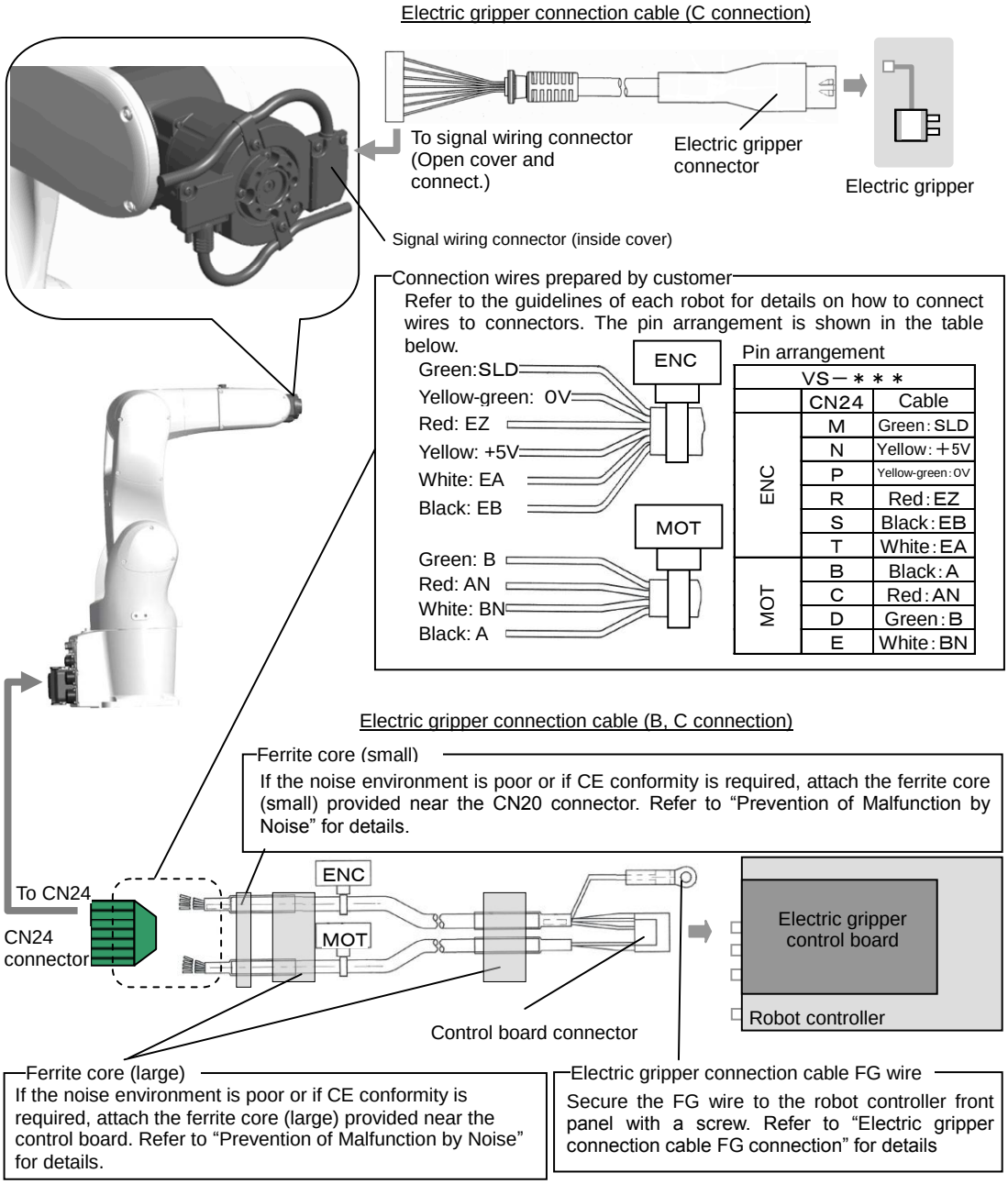
	VS-*** (VS-050/060/068/087)		
	CN20	Cable	CN21
ENC	E	Green: SLD	5
	F	Yellow-green: 0V	6
	G	Yellow: +5V	7
	H	Red: EZ	8
	J	Black: EB	9
	K	White: EA	10
MOT	A	Black: A	1
	B	Red: AN	2
	C	Green: B	3
	D	White: BN	4

	VP		
	CN20	Cable	CN21
ENC	1	White: EA	1
	2	Red: EZ	2
	3	Yellow-green: 0V	3
	6	Black: EB	6
	7	Yellow: +5V	7
	SHELL	Green: SLD	SHELL
MOT	4	White: BN	4
	5	Green: B	5
	8	Black: A	8
	9	Red: AN	9

	Other Robots		
	CN20	Cable	CN21
ENC	1	White: EA	A(1)
	2	Red: EZ	B(2)
	3	Yellow-green: 0V	C(3)
	4	Black: EB	D(4)
	5	Yellow: +5V	E(5)
	6	Green: SLD	F(6)
MOT	7	White: BN	G(7)
	8	Green: B	H(8)
	9	Black: A	J(9)
	10	Red: AN	K(10)

C connection

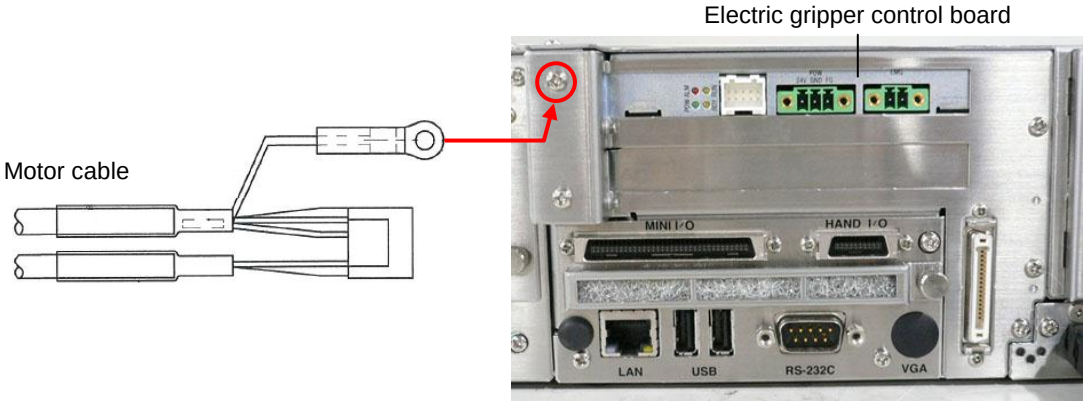
Connect as shown in the diagram below.


Electric gripper connection cable (C connection)
To signal wiring connector (Open cover and connect.)
Electric gripper connector
Electric gripper
Signal wiring connector (inside cover)
Connection wires prepared by customer
Refer to the guidelines of each robot for details on how to connect wires to connectors. The pin arrangement is shown in the table below.
Green:SLD
Yellow-green: 0V
Red: EZ
Yellow: +5V
White: EA
Black: EB
ENC
Green: B
Red: AN
White: BN
Black: A
MOT
Pin arrangement
VS－＊＊＊
CN24
Cable
ENC
M Green:SLD
N Yellow:＋5V
P Yellow-green:0V
R Red:EZ
S Black:EB
T White:EA
MOT
B Black:A
C Red:AN
D Green:B
E White:BN
Electric gripper connection cable (B, C connection)
Ferrite core (small)
If the noise environment is poor or if CE conformity is required, attach the ferrite core (small) provided near the CN20 connector. Refer to “Prevention of Malfunction by Noise” for details.
To CN24
CN24 connector
ENC
MOT
Electric gripper control board
Robot controller
Control board connector
Ferrite core (large)
If the noise environment is poor or if CE conformity is required, attach the ferrite core (large) provided near the control board. Refer to “Prevention of Malfunction by Noise” for details.
Electric gripper connection cable FG wire
Secure the FG wire to the robot controller front panel with a screw. Refer to “Electric gripper connection cable FG connection” for details

Electric gripper connection cable FG wire connection

Connect as shown in the diagram below.

Tightening torque: 0.6 N·m



Robot controller front panel

4.1.7. Connecting to Power Supply

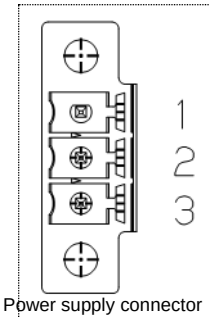
Power-supply voltage is as shown in the table below:

	Specification
Power Supply	24V DC±10%　1A MAX (motor power supply)

Disconnect the connector from the electric gripper control board and connect the power supply wire.

■Power supply connector

No	Symbol	Function
1	+24V	Motor power supply
2	0V	Power supply 0V
3	FG	Frame ground (for grounding)



Power supply connector

Applicable power supply cables: AWG28 – 16

Refer to the procedure shown below for details on how to connect the power supply to the connector.

Step 1

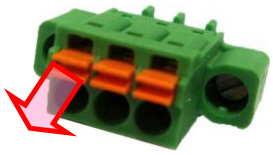
Push in the orange part with a minus driver, etc

Step 2

Fully insert the lead wire.

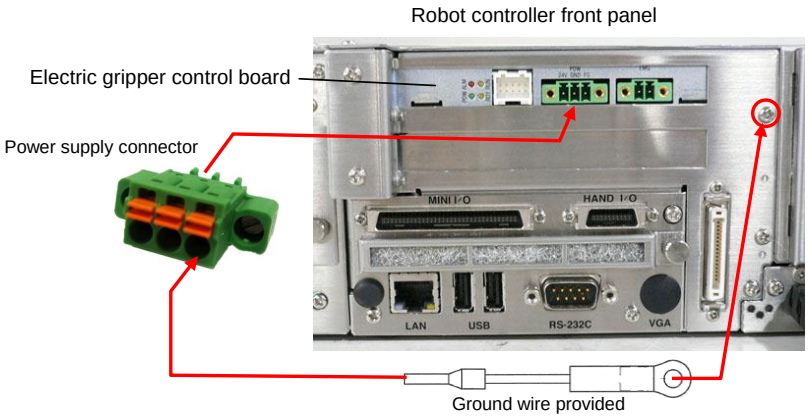
Step 3

Return the orange part to its original position.



Always use the ground wire provided, and connect FG to the robot controller front panel as shown below.

Tightening torque: 0.6 N·m



⚠ CAUTION

- Take care not to connect the power supply incorrectly. Incorrect connection may result in a serious incident such as fire. There is no power switch on the electric gripper control board, and therefore a suitable shut-off device (insulated) capable of cutting the power to the entire unit must be installed. Use a power supply with reinforced insulation at both the primary and secondary sides.
- Always turn OFF the power to the entire unit before wiring the electric gripper control board. Failure to do so may result in electric shock.

4.1.8. Grounding Work

⚠ DANGER

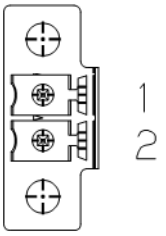
The motor current is controlled by PWM. Incorrect ground connection may cause transistor switching noise. Furthermore, electronic circuits for the CPU and so on are built into the electric gripper control board, and therefore it is necessary to perform wiring and take suitable measures to thoroughly prevent the intrusion of external noise. Wire and ground the control board properly to prevent such trouble.

4.1.9. Emergency Stop wiring Connection

Disconnect the emergency stop connectors from the electric gripper control board, and connect the emergency stop wiring.

■ Emergency stop connectors

No.	Symbol	Function
1	EMG1	Emergency stop contact input 1
2	EMG2	Emergency stop contact input 2



Emergency stop connectors

Applicable wiring: Use AWG 28 to 16.

Short circuit terminals 1 to 2 to deactivate the emergency stop.

Refer to “Connecting the Power Supply” for details on how to connect the power supply to the connector.

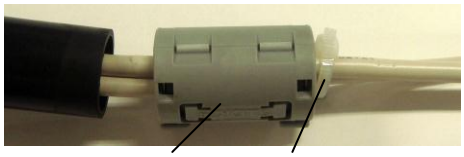
4.1.10. Prevention of Malfunction by Noise

CAUTION

- Be sure to install a serge absorber circuit to a coil such as a relay, electromagnetic contacting machine, induction motor, and break solenoid.
- Do not bundle the power supply line, motor line, and signal lines together or do not lay them in the same duct.
- Take the following steps if the noise environment is poor or if CE conformity is required

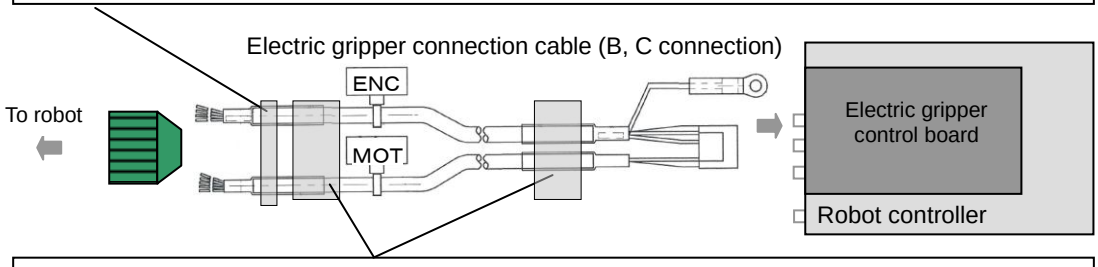
Attaching a ferrite core to the B, C connection cable

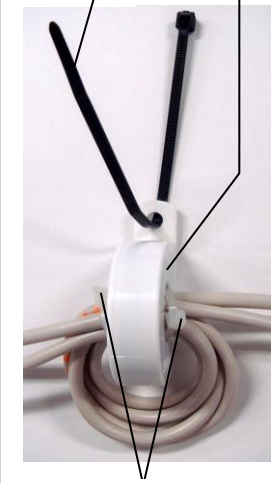
Attach the ferrite core as shown in the diagram below.



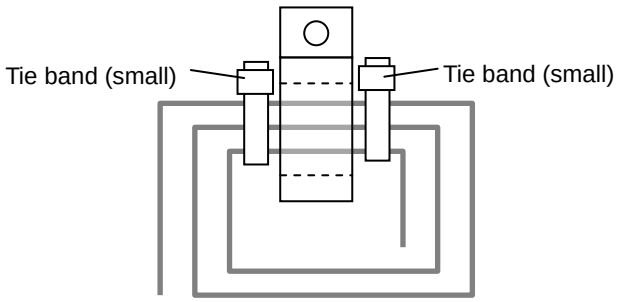
Attach the ferrite core (small) provided as close as possible to the connector connected to the robot without trapping the cable, and then secure it with one of the tie bands (small) provided.

Ferrite core (small) Tie band (small)





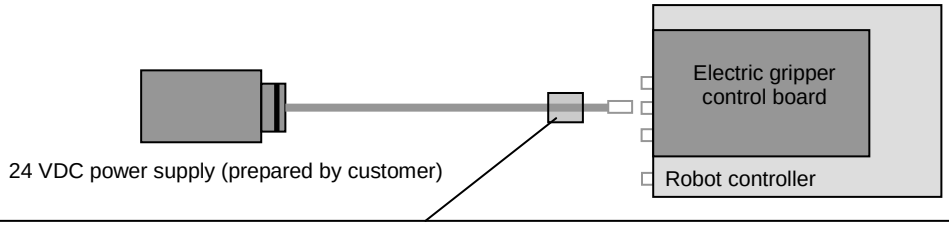
Attach the ferrite core (large) provided as close as possible to the electric gripper control board. Wind the ferrite core (large) 2 times, and secure with the tie bands (small) provided at the entrance and exit. Also, secure the motor cable at a suitable location with one of the tie bands (large) provided to prevent loads being applied to the motor cable.



Schematic diagram when winding the electric gripper connection cable 2 times.

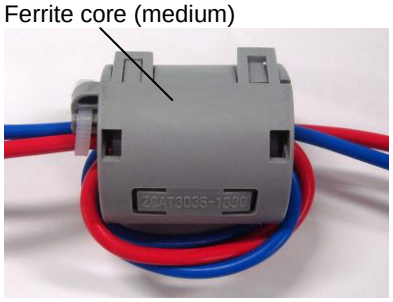
Attaching a ferrite core to the power cable

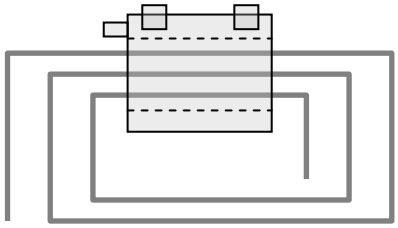
Attach the ferrite core as shown in the diagram below.



Attach the ferrite core (medium) provided as close as possible to the electric gripper control board without trapping the cable. Wind the ferrite core (medium) 2 times.

Ferrite core (medium)





Schematic diagram when winding the electric gripper connection cable 2 times

4.1.11. Other Notice on Wiring

① Wrong wiring

Wrong connection to the electric gripper control board and the electric gripper may cause product damage. Thoroughly check for proper connection.

② Fuse

There is a fuse in the electric gripper control board. The fuse is not for protecting the electric gripper control board itself but for preventing a secondary disaster in the case where the electric gripper control board damage was caused by earth fault.

4.2. Troubleshooting

4.2.1. If You Have a Problem with the Controller

When you contact us for a problem with the controller, please provide the following information as exactly as possible.

Item	Details
What has the problem?	Model of electric gripper Number of electric gripper
When the problem occurred?	Date purchased Service duration and operating condition
Why the problem occurred?	Conditions where the problem occurred
What problem occurred?	Detailed symptom of the problem
How often the problem occurred?	Frequency of occurrence of the problem

4.2.2. Measures against Problems

If you faced a problem while using the controller, solve the problem referring to the following table. If you still cannot solve the problem after doing so, please contact a local dealer or us.

No.	Symptom	Possible cause	Items checked	Measure
1	When turning on controller provided by customer, motor is not excited or fingers cannot return to their original positions.	No power is supplied.	・Check the POW LED on front panel of electric gripper control board. ・Check wiring of 24V power supply. ・Check power pressure using a tester. ・Remove the power connector to measure resistance between the power terminals	・Replace the electric gripper control board if there is no problem with the power supply. ・If resistance is immeasurable between the power terminals, fuse may be blown. Replace electric gripper control board.
		Alarm error may be occurred.	When ALM (LED lamp) on the electric gripper control board is on,	Check the alarm details at the robot controller error log.
2	When inputting special instructions, controller cannot work.	Original position return has not been completed.	Check operating conditions in electric gripper screen and command. Check the RPRG signal is asserted.	Perform original position return.
		Point movement is not feasible.	Check settings of point data.	Input correct point data.
3	Abnormal sound and vibration are generating.	Incorrect parameter settings	Check actuator type, model, and parameter data displayed in electric gripper screen.	Initialize parameters with electric gripper screen.
		Failure to tightly fix the electric gripper	Fixing screws	Tighten screws for loose fixing
		Problem with the guide	Check foreign objects exist in the guide. Check any damage or deformation on the guide.	Replace guide. Check to make sure that the controller is not handled forcibly.
		Electric gripper control board failure	Try to use another electric gripper control board.	If it properly worked, replace electric gripper control board.
		Motor failure	Try to use another electric gripper.	If it properly worked, replace electric gripper.
4	Since the fingers made a bump at stroke end while returning to their original positions, the machine stops due to occurrence of alarm.	Inconsistent settings	Check the actuator type and gripper model displayed in electric gripper screen.	Initialize the parameters with the electric gripper screen.
		Incorrect parameter settings or failure	Check the parameters with electric gripper screen.	Initialize parameters with the electric gripper screen.
5	Misalignment of original position occurs.	Damaged ball screws (FS/FT type)	Check the ball screws.	Replace the ball screw.
		Connection failure of pulley (FS/FT type)	Check the fixing parts.	Tighten for loose fixing.
		Some teeth of belt are missing. (FS/FT type)	Movement speed was increased too much. Check how much the belt is bent.	Modify the parameters. Adjust the belt.

No.	Symptom	Possible cause	Items checked	Measure
		Malfunction caused by noise.	・Check the ground terminal on electric gripper control board is utilized for ground. See “Electric gripper connection cable FG connection”, “Power supply connection”. ・Check for the connection with cable connectors. ・Check if there are a welding machine, electric discharge machine, etc. near the controller. ・Check if the relay which turns on/off a huge motor exists near electric gripper control board.	・Keep controller as far away from noise source as possible. ・Consider installation of a noise filter and insulated transformer. ・Attach a noise killer to relay contact. ・Keep the motor and encoder cable away from the power cable.
6	Electric gripper speed is too fast or too slow.	Incorrect the parameter setting values.	Check the actuator type and gripper model displayed in electric gripper display.	Initialize the parameters with electric gripper display.
		Change the speed setting.	Check speed parameter (PRM9)	Modify parameters.
7	Impossible to move to the electric gripper screen	License registration has not been done yet.	Confirm whether the license registration has completed	Register the license. If the license is not provided, please contact to Denso Wave.
8	Impossible to operate the electric gripper screen	The electric gripper control board does not correspond to the specified electric gripper number.	Confirm whether the electric gripper control board corresponds to the specified gripper number and whether they connect properly.	Connect appropriate electric gripper control board which corresponds to the specified gripper number.
		The electric gripper is not activated	Confirm whether the electric gripper is activated	Activate the electric gripper of the specified gripper number. For the electric gripper activation process, see “Operation guide”.
9	When execute the electric gripper command, the error “Invalid index” is issued	The electric gripper control board does not correspond to the specified electric gripper number.	Confirm whether the electric gripper control board corresponds to the specified gripper number and whether they connect properly.	Connect appropriate electric gripper control board which corresponds to the specified gripper number.
		The electric gripper of the specified gripper number is not activated	Confirm whether the electric gripper of the specified gripper number is activated	Activate the electric gripper of the specified gripper number. For the electric gripper activation process, see “Operation guide”.
		License registration has not been done yet.	Confirm whether license registration has completed	Register the license. If the license is not provided, please contact to Denso Wave.

5. Specifications

Item		Specification
Axis control	Number of control axes	1 axis
	Position detection method	Optical rotary encoder
	Minimum setting distance	0.01mm
	Speed setting	Set to 10 – 100% of parameter maximum speed.
	Gripping force setting	Set to 30 – 100% at point data.
Protective function (alarm)		See “Alarm Messages”, “Error Messages”.
LED indicator		4 indicators: Power supply (green), RDY (yellow), RUN (yellow), ALM(red)
Power supply	Motor power supply	24V DC ±10% 1.0A MAX
General	Operating temperature	Conforms to robot controller installation environment. (0 – 40 °C)
	Operating humidity	35～85%RH（without dew condensation）
	Storage temperature	-10～+65 ℃
	Protection level	Conforms to robot controller installation environment.
	Vibration, impact	9.8 m/s2 (1.0 G) or less
	Altitude	1000 or less when operating
Contact life time		No contacts
Environmental load material compliance		RoHS

RC7M CONTROLLER
ELECTRIC GRIPPER CONTROL BOARD

USER'S MANUAL

First Edition August 2012
Second Edition January 2013

DENSO WAVE INCORPORATED

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The purpose of this manual is to provide accurate information in the handling and operating of the robot. Please feel free to send your comments regarding any errors or omissions you may have found, or any suggestions you may have for generally improving the manual.

In no event will DENSO WAVE INCORPORATED be liable for any direct or indirect damages resulting from the application of the information in this manual.